Value Planning

Draft of Final Report

Elwha River Water Quality
Mitigation Project

A1R-1751-3408-NPS-11-0-5 (1); ELWH3

September 20, 2000

Conducted in Cooperation with the
National Park Service, the City of Port Angeles, and
the Bureau of Reclamation, Pacific Northwest Region

Bureau of Reclamation, Technical Service Center, Denver, Colorado

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Executive Summary

The Value Study Team met at the Elwha Restoration Project Office in Port Angeles, Washington, on September 11, 2000, for a 3-day study of the Elwha River Water Quality Mitigation Plan. The target cost of the mitigation concept is $40,000,000 (see page 5, Current Description for target cost development).

The Team developed nine proposals which are summarized below. If all the avoidance proposals are accepted, their maximum avoidance potential is $7,325,000. Note that in calculating the maximum potential avoidance, the cost of the study ($40,000) was deducted only once.

The proposals only address portions of the proposed mitigation and not the full scope of mitigation facilities as a whole. Proposal Nos. 6, 7, and 8 are mutually exclusive of each other. Proposal Nos. 1-5, and 9 could be combined with other proposals for increased project benefits.

<u>Proposal No. 1</u>. Industrial Water storage at Rayonier Site. The estimated avoidances of this proposal are $3,500,000 before deducting any study and/or implementation costs.

<u>Proposal No. 2</u>. Construct Treated Water Storage for Port Angeles. The estimated added costs of this proposal are $635,000 before adding any study and/or implementation costs and without City contributions, if any.

<u>Proposal No. 3</u>. Water Treatment by Ceramic Microfiltration. The estimated added costs of this proposal are $16,360,000 before adding any study and/or implementation costs.

<u>Proposal No. 4</u>. Infiltration Gallery Pilot Testing. The estimated avoidances of this proposal are $7,365,000 before deducting any study and/or implementation costs.

<u>Proposal No. 5</u>. Reduce Capacity of Proposed Infiltration Gallery. The estimated avoidances of this proposal are $7,365,000 before deducting any study and/or implementation costs.

<u>Proposal No. 6</u>. All Municipal and Industrial Water Supply From Ranney Collectors. The estimated added costs of this proposal are $22,500,000 before adding any study and/or implementation costs.

<u>Proposal No. 7</u>. All Water Supply From Infiltration Gallery, existing Ranney as a backup. The estimated avoidances of this proposal are $5,765,000 before deducting any study and/or implementation costs.

<u>Proposal No. 8</u>. Fishery and Industrial Supply From Infiltration. The estimated avoidances of this proposal are $2,565,000 before deducting any study and/or implementation costs.

<u>Proposal No. 9</u>. Bench Top Filter Testing. The estimated avoidances of this proposal are $4,865,000 before deducting any study and/or implementation costs.

Choosing by advantages (CBA) was not used in this study because many of the proposals address different portions of the mitigation effort and could not be compared to each other. Those proposals that could be compared to each other were not developed in enough detail to make reasonable judgements comparing their attributes.

Other Ideas: During the development phase of the study, the team discussed several ideas that could have a significant impact on the design of this project. These ideas were not developed into proposals due principally to time limits. The ideas could be used separately or in combination. Some of the ideas are discussed briefly here:

Promote 75 percent industrial water reuse. There may be a significant potential to increase reuse of industrial water. If reuse can reduce industrial water consumption by 50 percent, it would decrease the need to divert, treat, and supply large amounts of river water.

Further investigate the performance of the Ranney Collector at Kelso, Washington (on the Cowlitz River near Mount Saint Helens) or similar collectors and infiltration galleries and consider 1) increasing the capacity of the existing Ranney Collector (by adding or lengthening laterals) and 2) deferring construction of a new Ranney Collector. The Kelso Ranney Collector near Mt. Saint Helens has operated for many years since the eruption with very minor yield reduction even though 16 feet of sediment were deposited near the collector.

Cooperate with the City to increase municipal water storage. The City is already considering adding to its treated water storage capacity. This idea is mentioned in Proposal No. 2, but could be expanded into a separate proposal.

Municipal water demand could be reduced by promoting water efficient fixtures to municipal users.

The Team identified 30 additional ideas for further consideration and development that are listed in the "Disposition of Ideas" table near the end of this report.

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Acknowledgment of Design Team and Consultant Assistance

The Value Study Team wishes to express their thanks and appreciation to the Design Team Leader, Ms. Ellen Abart; the Elwha Project Manager, Dr. Brian Winter; and the members of the design team, who fully and cordially provided all requested information and consultation on the conceptual design. The team would not have been as successful without the design team's cooperation and assistance.

The Value Study Team wishes also to express thanks and appreciation to those listed on the Consultation Record of this report. Their cooperation and help contributed significantly to the technical foundation and scope of the team's investigation and final proposals.

The goal of the value planning method is to achieve the most appropriate and highest value solution for the project. It is only through the efforts of a diverse, high-performing team, including all those involved, that this goal can be achieved. This report is the product of such an effort.

Value Method Process

The Value Method is a decision making process, originally developed in 1943 by Larry Miles, to creatively develop alternatives that satisfy essential functions at the highest value. It has many applications, but is most often used as a management or problem-solving tool.

The study process follows a Job Plan that provides a reliable, structured approach to the conclusion. Initially, the team examined the component features of the program, project or activity to define the critical functions (performed or desired), governing criteria, and associated costs. Using creativity (brainstorming) techniques, the team suggested alternative ideas and solutions to perform those functions, consistent with the identified criteria, at a lower cost or with an increase in long term value. The ideas were evaluated, analyzed, and prioritized, and the best ideas were developed to a level suitable for comparison, decision making, and adoption.

This report is the result of a "formal" Value Study, by a team comprised of people with the diversity, expertise, and independence needed to creatively attack the issues. The team members bring a depth of experience and understanding of the discipline they represent, and an open and independent enquiry of the issues under study, to creatively solve the problems at hand. Ideally, the team members have not been notably involved in the issues prior to the study. The team applied the Value Method to the issues and supporting information, and took a "fresh look" at the problems to create alternatives that fulfill the client's needs at the greatest value.

Current Description

The Elwha Act, PL 102-495, calls for full restoration of the ecosystem and habitat for anadromous species in the Elwha River watershed, including deconstruction of the Elwha and Glines Canyon Dams. As the dams are removed (short-term), significant entrapped sediments will be released in high concentration periods, approximately every two weeks as notches are cut lower and lower in the dams. During these high concentration periods the sediments will "pulse" through the lower reaches of the Elwha River. After dam removal, the sediment load (long-term) in the river is expected return to natural pre-dam levels. Both short-term and long-term sediment loads will reach the intakes for the City of Port Angeles municipal and industrial supplies and fisheries (hatcheries) for both Washington State and the Lower Elwha Klallam Indian Tribe, among other water users. See Figure 1.

The Elwha River Water Quality Mitigation Project is intended to reduce or eliminate the adverse impacts of short-term and long-term sediment loads, as well as other water quality impacts, to the downstream water users. The Implementation Environmental Impact Statement, (IEIS) outlined a baseline mitigation effort including an infiltration gallery with industrial pretreatment, a new Ranney collector combined with cartridge filters for municipal water, temporary closure of the State Rearing Channel, all located at current facilities site, and flood protection of the site, at an estimated cost of $31 million.

The study team used the IEIS cost estimate of $31,000,000 for the baseline in the draft report. However, during the study and presentation the team determined that this baseline was "obsolete." The City had completed a review of this estimate and concluded that more effort would be needed to hold the City "harmless." The City recommended modifications to the baseline that would increase the estimated project cost to about $60,000,000. For this Final Report the study team felt that a reasonable project target cost of $40,000,000 should be used to represent a project effort in between these two estimates. To compare the study team proposals to portions of this increased project, the IEIS breakout (component) costs were scaled up to target cost amounts using a factor of 1.33 ($40,000,000/$30,000,000).

The current, preliminary design effort is investigating: 1) alternate intake technologies such as Ranney collectors, deep infiltration galleries, shallow infiltration galleries, and surface water diversions from the Upper and Lower Elwha River; 2) temporary sources such as Morse Creek, Indian Creek, and Little River; and 3) alternate treatment options such as coagulation and sedimentation, membrane filtration, precoat filtration, intermediate disk filtration, and waste residual disposal options. See Figure 2.

Figure 1. Location Map and Alternative Facility Sites

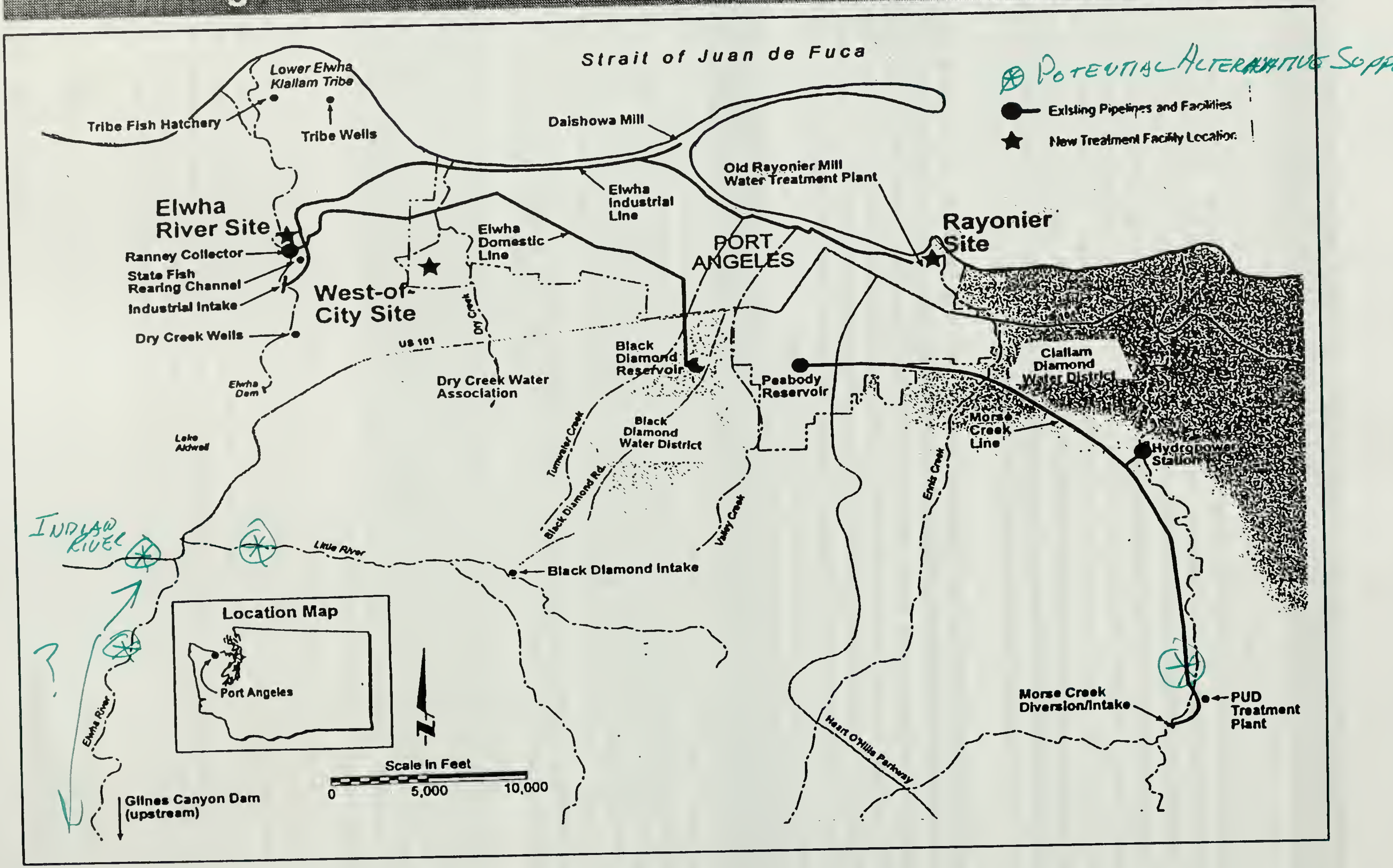
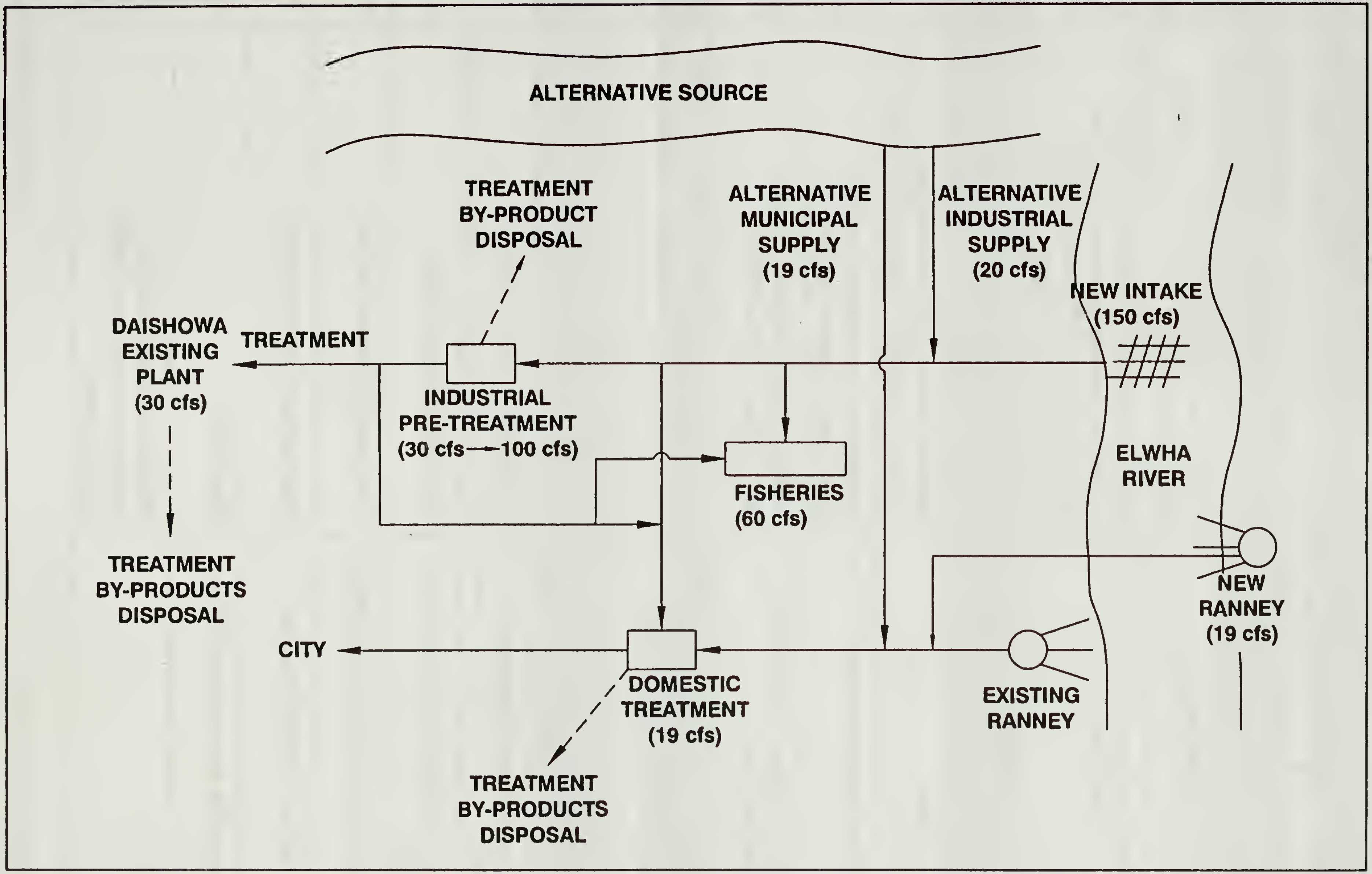


Figure 2. Water Use Conceptual Schematic



Owner, Users, and Stakeholders List

Identification and Issues Determination

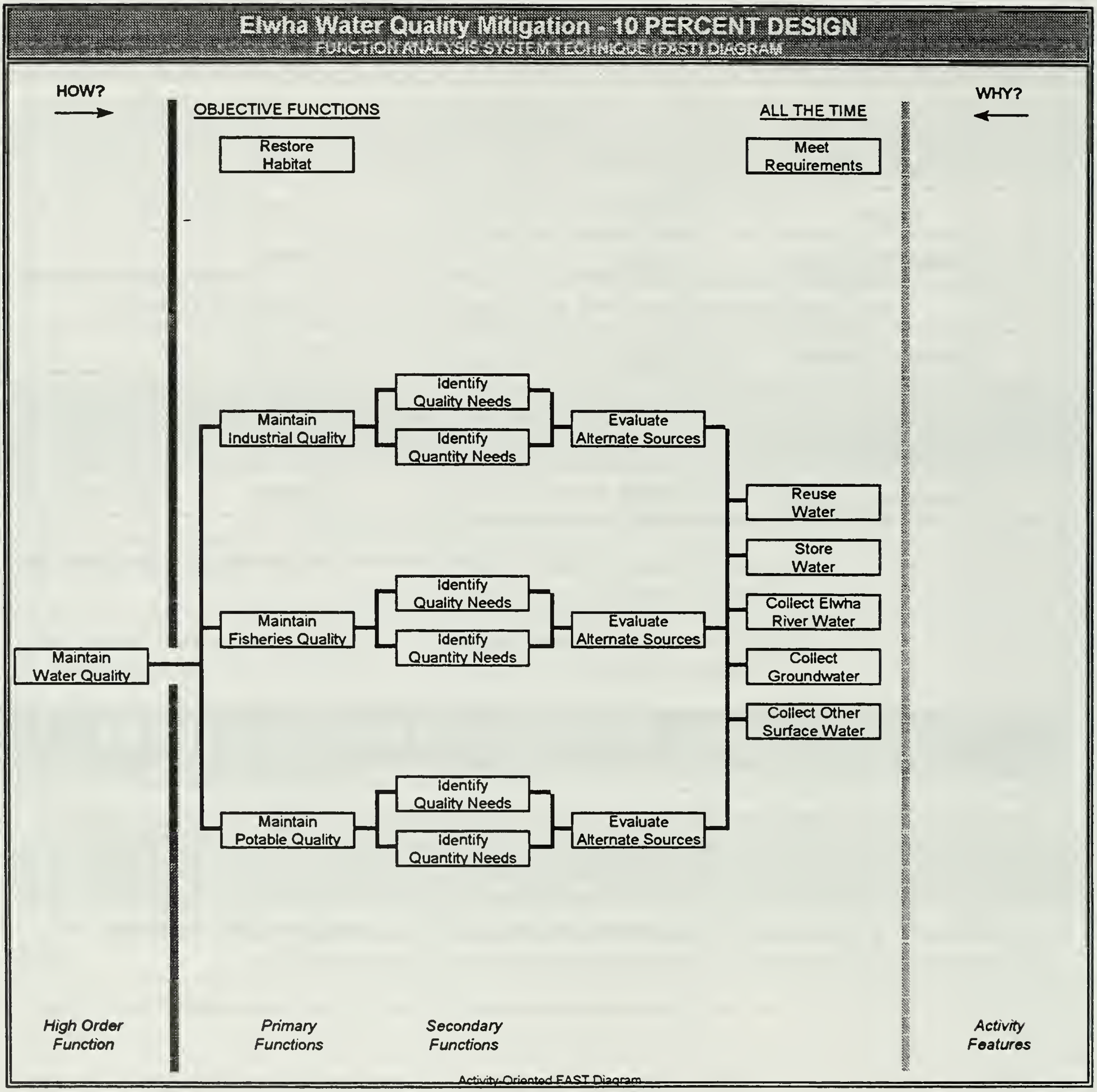
Owner (Identification of the owner or owners)	Owner Issues (Identification of issues important to every owner)	Desire/ Criteria
National Park Service	Anadromous Habitat Restoration Elwha Act Compliance	C C
City of Port Angeles	Maintenance of water quality and supply Operations and Maintenance Effort/Cost GWI compliance (groundwater under influence of surface water)	C C,D C
User (Identification of the user or users)	**User Issues** (Identification of issues important to every user)	**Desire/ Criteria**
Daishowa Mill	Industrial water quality and supply Operations and Maintenance Effort/Cost	C C,D
Lower Elwha Klallam Tribe	Fishery water quality and supply Anadromous Species Habitat	C C
Washington State Department of Fish and Wildlife	Fishery water quality and supply Anadromous Species Habitat	C C
Dry Creek Water Association, Elwha Place Water Association	Water quality and supply	C
Stakeholder (Identify of the stakeholder or stakeholders)	**Stakeholder Issues** (Identification of issues important to every stakeholder)	**Desire/ Criteria**
Washington State Department of Health	Regulation, Drinking Water	C
Washington State Department of Ecology	Regulation, Water Rights	C
National Marine Fisheries Service	Anadromous Species Habitat	C, D
U.S. Fish and Wildlife Service	Anadromous Species Habitat	C, D
Elwha Morse Management Group	Restoration	C, D
Public	Water Quality and Supply Anadromous Species Habitat Local Economy	D D D

Function Analysis

Component	Active Verb	Measurable Noun
Elwha Act	Restore	Habitat
Project	Mitigate	Sediment Effects
Intake Structure	Supply	Water
	Exclude	Coarse Sediments
Ranney Collector	Supply	Water
	Exclude	Coarse Sediments
Channel/pipeline/tunnel	Transport	Water
Treatment Facility	Clean	Water

Function Analysis System Technique (FAST)

The Value Study Team used the function-analysis process to generate a Function Analysis System Technique (FAST) diagram, designed to describe the present solution from a functional point of view. The FAST diagram helped the Team identify those design features that support critical functions and those that satisfy noncritical objectives. The FAST diagram also helped the Team focus on potential value mismatches, and generate a common understanding of how project objectives are met by the present solution.


Elwha Water Quality Mitigation - 10 PERCENT DESIGN
FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM
HOW?
WHY?
OBJECTIVE FUNCTIONS
ALL THE TIME
Restore Habitat
Meet Requirements
Maintain Water Quality
Maintain Industrial Quality
Maintain Fisheries Quality
Maintain Potable Quality
Identify Quality Needs
Identify Quantity Needs
Evaluate Alternate Sources
Reuse Water
Store Water
Collect Elwha River Water
Collect Groundwater
Collect Other Surface Water
High Order Function
Primary Functions
Secondary Functions
Activity Features
Activity Oriented FAST Diagram

Water Quality Mitigation Project

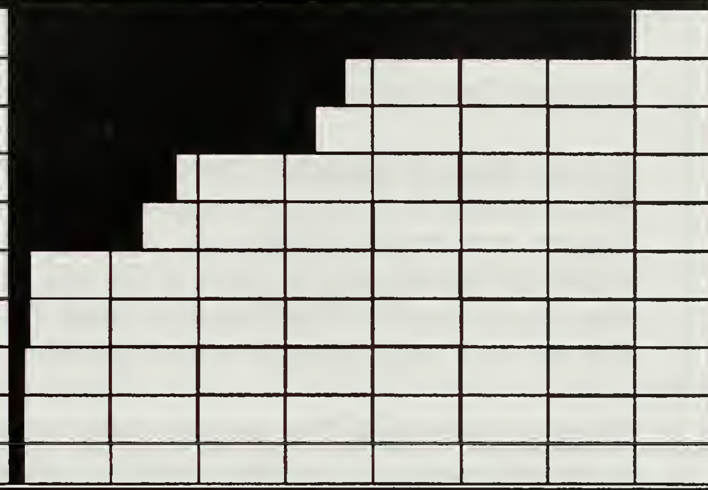
VALUE STUDY

COST MODEL

of Implementation EIS Concept Design

COMPONENT/PERCENT PROJECT COST	
Infiltration gallery and diversion	(39.9%)
Open channel pretreatment	(21.2%)
New Ranney well (incl. DCWA)	(19.3%)
Filtration Plant (incl DCWA)	(10.1%)
Fish hatchery water supply	(7.9%)
Mound sewage treatment system	(0.6%)
Contingency fund for private wells	(0.6%)
Temporary Elwha Place HOA	(0.2%)
Install new wells	(0.1%)
MIOX disinfection system	(0.1%)

PROJECT COST PROPORTION



Cost Model and Estimate Information

The Value Study Team cost model is based on the conceptual design estimates provided by the design team for the preferred project design. The cost model was developed by the Value Study Team and was used to focus on features with the greatest potential for savings and to highlight areas of value mismatch.

Unit prices were reviewed by the Cost Estimator and Value Study Team members, to ensure reliability and applicability.

Cost avoidances/savings and the original design concept estimates are of the same general level of development, although these costs may vary as final designs are pursued.

Proposal No. 1

Description

Proposal No. 1. Industrial Water Storage at Rayonier Site

- Proposal Description: Construct raw water storage for industrial users at the Rayonier site.
- Critical Items to Consider: Storage was not analyzed as a mitigation in the final Elwha IEIS. This proposal may require a supplement. The Rayonier site, in places, is contaminated with Dioxins and other contaminants, and may restrict construction activities, and add other significant constraints to users of the site. This proposal assumes that an existing tank at the site can be used to store industrial water (consistent with the needs of the ultimate user) and that the tank capacity is 10 million gallons.
- Ways to Implement: The average daily industrial demand is 9 million gallons per day (mgd). A five day supply (including a margin of safety) is estimated to be 10 mg x 5 days or 50mg. Assuming that the existing tank can be retrofitted and renovated to meet the needs of this project, four additional 10 mg storage tanks would be constructed. Water transmission to the tank farm would be constructed primarily through existing pipelines, however a 2000-foot extension of 30-inch pipeline would be needed from approximately Water Street into the tank farm. Water would be diverted from the Elwha River to the tank farm during low sediment concentrate windows.
- Changes from the Baseline Concept: Eliminates the need for industrial pretreatment of water.

Advantages	Disadvantages
• Eliminates the need for industrial pretreatment. • Frees up land that would be used for pretreatment facilities. • Eliminates discharging treatment waste by-products into the Elwha River. • Will provide an emergency supply if anything goes wrong with the intake proposal. • Eliminates need for temporary alternative industrial supply.	• Significant capital outlay for a deconstruction period need.

Proposal No. 1

Potential Risks
Five days of storage may not be enough. The sediment window was derived from the Reclamation model which contains significant uncertainty. If the sediment model is wrong, pretreatment may be required even with the implementation of this proposal.

Cost Items	Nonrecurring Costs
Target Cost*	$ 22,000,000
Value Concept	$ 18,500,000
Avoidance	$ 3,500,000
Value Study Costs	$ 40,000
Implementation Costs	$ 0
Net Avoidances	**$ 3,460,000**

* IEIS baseline $16,500,000 x 1.33 = $22,000,000

Proposal No. 2

Description

Proposal No. 2. Construct Treated Water Storage for Port Angeles

- Proposal Description: Construct treated water storage for the City of Port Angeles.
- Critical Items to Consider: This proposal can be implemented in conjunction with the industrial-water storage proposal. It was not considered in the Elwha River Ecosystem Restoration IEIS. A supplemental EIS may be necessary.
- Ways to Implement: To avoid issues associated with high-sediment concentration days, water would be pumped from the city's existing Ranney Well during low-sediment concentration windows, treated, and transferred to three 10-million-gallon storage facilities. Two storage tanks would be constructed in the city's middle pressure zone and one facility would be constructed in the high-pressure zone. This proposal would provide sufficient storage to provide a five-day supply during high-sediment events that will occur during dam deconstruction. See Figure 3.
- Changes from the Baseline Concept: Eliminates the need for locating an alternative municipal supply. May add City Storage funding to the total project funds.

Advantages	Disadvantages
• The Port Angeles Comprehensive Water System Plan identified the need for an additional 10 million gallons of treated-water storage capacity in the high-pressure zone. Thus, potential cost-share opportunities are created between the National Park Service and the City of Port Angeles. • Would avoid pumping of the City's existing Ranney well during high sediment events, thus reducing long-term maintenance costs and extend the service life of that facility. • Provides needed backup supply.	• Significant capital outlay for a deconstruction period mitigation, although it is somewhat offset with cost-share opportunities. • Type of treatment facility decided on for potable water treatment may eliminate the need for a back-up water supply via storage.

Proposal No. 2

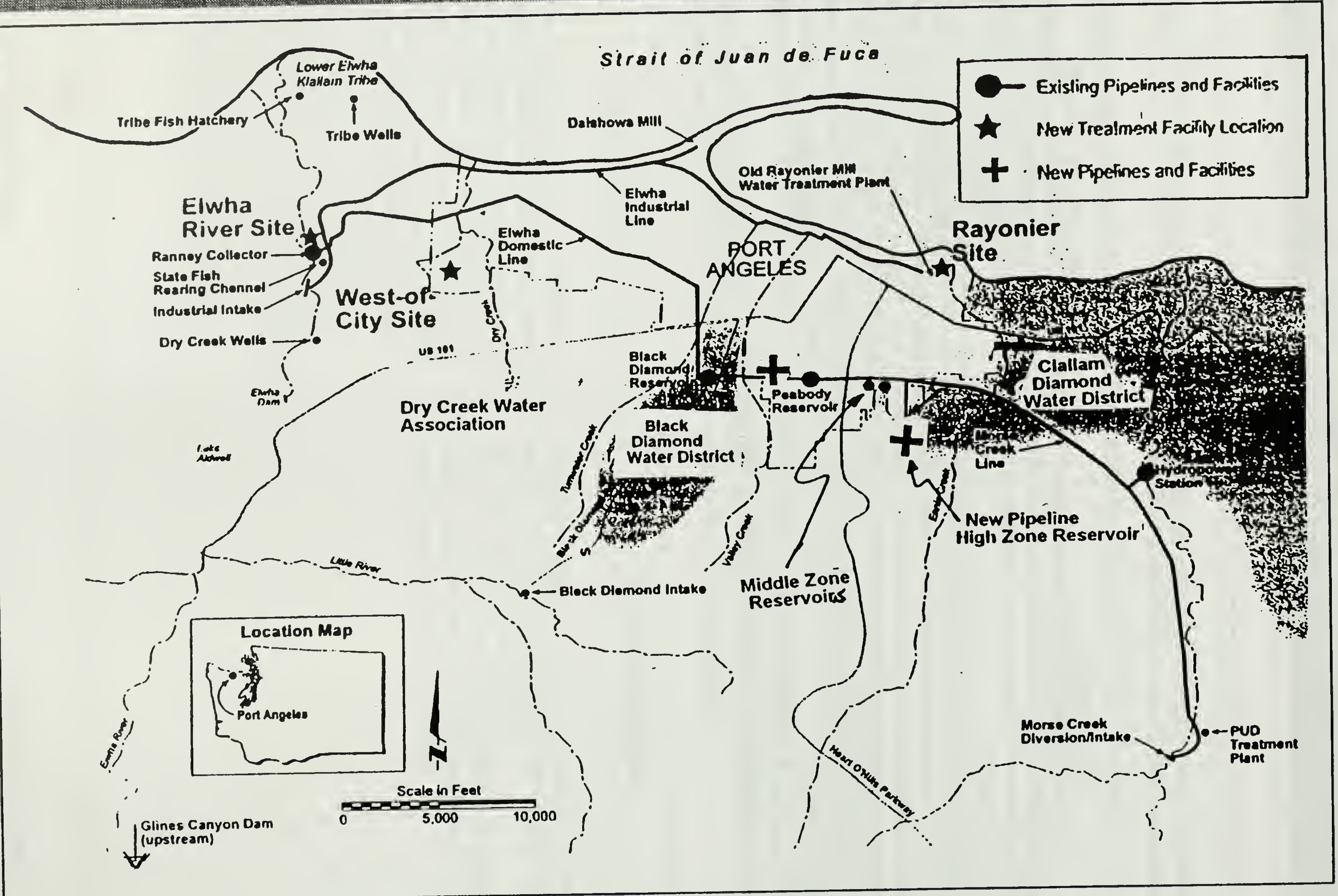
Potential Risks

Five days of municipal storage may not be enough if sediment events persist beyond what is predicted by the Bureau of Reclamation's model.

Cost Items	Nonrecurring Costs	
Target Cost*	$	14,365,000
Value Concept **	$	15,000,000
Avoidance	$	(635,000)
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**(675,000)**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000
** Does not reflect City cost-share portion, yet to be determined.

Figure 3. Municipal Water Storage Proposal



Proposal No. 3

Description

Proposal No. 3. Water Treatment by Ceramic Microfiltration.

- Proposal Description: In place of baseline intake and treatment processes, use ceramic microfiltration to accomplish water treatment. This is a process using ceramic α-alumina cylinders containing a bundle of axially oriented cylindrical feed channels mounted inside a metal housing to filter the process water. The process is driven by a pressure on the feed water of 20 to 30 lb/in^2. Periodically, perhaps every ten or twenty minutes, a pressure pulse is applied in the opposite direction to dislodge the accumulated cake into the flowing stream. This process is being used in the treatment of acid mine drainage and has been at least tested in other applications.

- Critical Items to Consider: 1) If this process were to be employed, it must be decided which product streams to use it on. 2) If there is a significant amount of dissolved iron and manganese in the feed water, some pretreatment will be required to convert these materials into insoluble forms.

- Ways to Implement: Standard procurement and installation procedures.

- Changes from the Baseline Concept: Water would be taken from the Elwha River at the present water diversion structure, treated, and supplied to users.

Advantages	Disadvantages
• Simple, one-step process. • Requires little operator attention. • High quality effluent: i.e., turbidity of 0.06 NTU, less than 2 ppm Total Suspended Solids, Silt Density Index less than 1, greater than 6 log reduction in total coliform, absolute filter for Cryptosporidium and Giardia. • Modular. Capacity can be increased in increments (size depending on design of original installation). Portions only of plant can be used, as required. • Process is compact. Skid footprint is 700 ft^2 per million gallons per day capacity.	• Process equipment is expensive now. • Manufacturer's claims have not been verified in the field. • This process is not presently permitted for drinking water treatment. • The degree to which filtration unit capacity will decrease with time and the amount and frequency of cleaning required are unknown. • There appears to be only one manufacturer of this type of equipment. • This would be an unusually large installation for this manufacturer and the appropriate system for this application would have to be specially designed.

Proposal No. 3

Potential Risks

This process removes suspended and/or solid materials from the water being treated. The amount of dissolved iron and manganese which will occur in the feedwater after dam removal is not, and possibly cannot be, known. Conversion of iron into insoluble forms may occur naturally or it may require adjustment of pH to slightly higher than natural values. If a significant concentration of dissolved manganese is present in the feedwater, reduction to acceptable levels may require more effort.

Uncertainties can be reduced by evaluation tests on bench scale or with on-site unit.

This would be an extension of the process into a relatively new field.

Cost Items	Nonrecurring Costs	
Target Cost*	$	10,640,000
Value Concept	$	27,000,000
Avoidance	$	(16,360,000)
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**(16,400,000)**

* IEIS baseline $8,000,000 x 1.33 = $10,640,000

Proposal No. 4

Description

Proposal No. 4. Infiltration Gallery Pilot Testing.

- Proposal Description: Infiltration gallery pilot testing.
- Critical Items to Consider: Sample location/character, Total Suspended Solids (TSS) comparable to anticipated quality, assess performance verses risk.
- Ways to Implement: Establish laboratory and sampling apparatus. See Figure 4 and Table 1.
- Changes from the Baseline Concept: No bench scale testing is provided in the baseline concept.

Advantages	Disadvantages
• Obtain better design data. • Develop risk versus performance, will determine need for backup systems and/or additional treatment. • Reduced unit process cost is likely to result in savings up to $5,000,000, depending on test results.	• Timing/data available.

Potential Risks

Results may not be representative of actual conditions.

Proposal No. 4

Cost Items	Nonrecurring Costs
Target Cost*	$ 14,365,000
Value Concept**	$ 7,000,000
Avoidance	$ 7,365,000
Value Study Costs	$ 40,000
Implementation Costs	$ 0
Net Avoidances	**$ 7,325,000**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000

** Reduced unit process cost is likely to result in savings up to $5,000,000, depending on test results.

Figure 4. Pilot Schematic

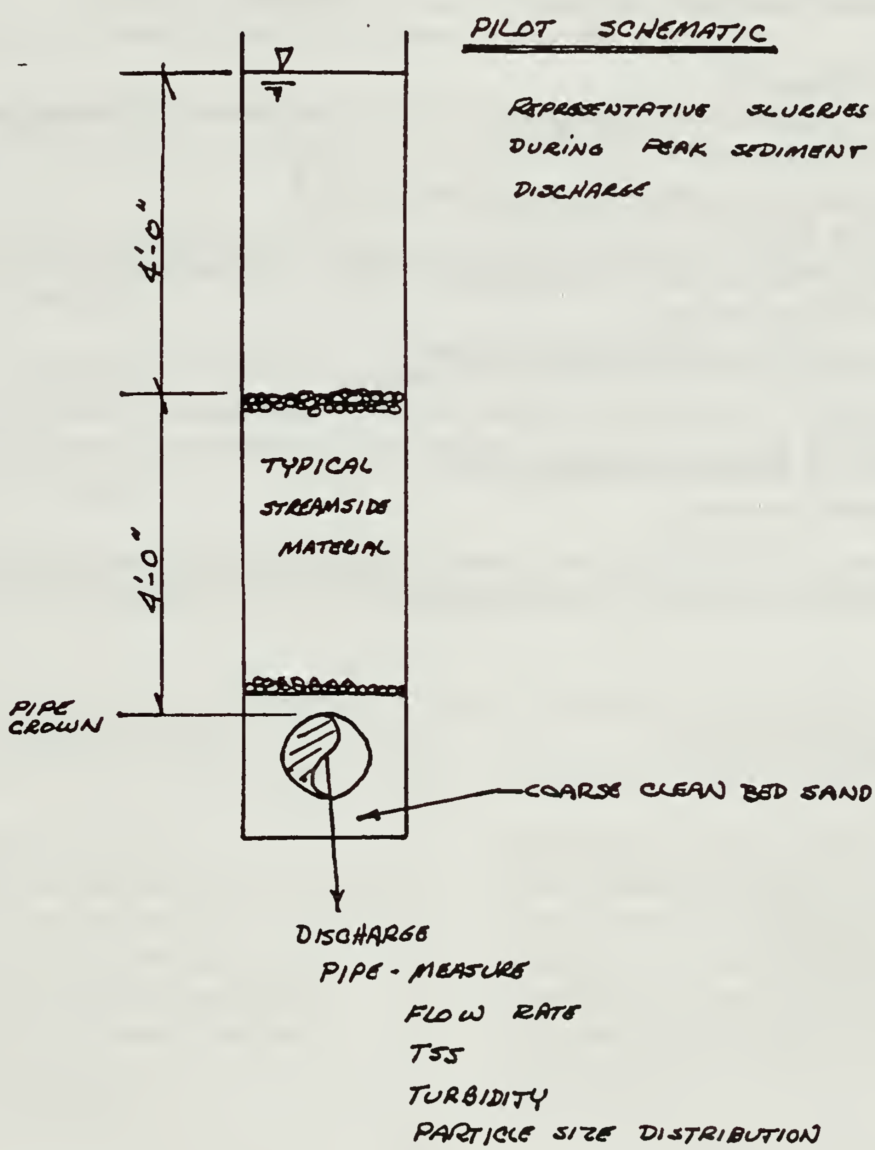


Table 1. Testing Procedure

Samples to obtain
-Cores from sediment beds behind dams
-Cores from riverbed material to be placed over an infiltration gallery

Set up column per Figure 4
Make up 4 slurry concentrations using sediment ranging from 1,000 to 40,000 mg/l TSS

- Measure the following parameters at constant head
  -Flow rate verses time
  -Influent/effluent (filtrate) TSS at beginning, middle, and end of run
  -Turbidity per TSS as above
  -Particle size distribution of feed and filtrate

- Backwash Testing
  -Backwash with 10 percent of filtered flow
  -Evaluate flowrate recovery

Proposal No. 5

Description

Proposal No. 5. Reduce Proposed Infiltration Gallery Capacity.

- Proposal Description: Maintain current Ranney collector for municipal supply (19 cfs) and construct a new infiltration gallery for industrial and fishery supply (150 cfs)

- Critical Items to Consider: Sediment load and "break through" on infiltration gallery. Evaluate potential for stream migration away from Ranney collector which may result in capacity reduction.

- Ways to Implement: Infiltration upgrades to existing Ranney system (i.e., backwash), infiltration gallery construction in the river channel upstream of current diversion structure (as on baseline), or infiltration gallery constructed on river bank as "in-situ slow sand filter." See Table 2.

- Changes from the Baseline Concept: Reduce design flow for industrial infiltration gallery from 300 cfs (baseline) to 150 cfs. Enhanced existing Ranney Collector

Advantages	Disadvantages
• Reduced design flow. • Potentially reduces requirement for industrial pretreatment. • Optimizes municipal system by providing backwash capability. • Potentially minimizes residual solids disposal. • Lower capital cost.	• Potential clogging of either infiltration gallery. • Filter efficiency of Ranney or infiltration gallery unknown under anticipated conditions. • Anticipate higher O&M cost. • The city's industrial water intake capacity reduced from capacity of existing surface water intake.

Potential Risks

Infiltration gallery design may not remove more solids than proposed by baseline design (75 percent removal). Clogging of infiltration gallery and reduced yield. Value Study Team recommends additional studies to quantify risks. See Proposals No. 4 and 9.

Proposal No. 5

Cost Items	Nonrecurring Costs	
Target Cost*	$	14,365,000
Value Concept **	$	7,000,000
Avoidance	$	7,365,000
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**7,325,000**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000

**Estimate based on unit flow costs escalated by square root of 2, $300 K estimate of backwash system for existing Ranney collector.

Table 2. Proposal No. 5. Intake Design Flows

Ranney Collector
Municipal supply – 12.3 MGD (will meet 20-year projected growth)

New Infiltration Gallery
Daishowa – 19.5 MGD
State Rearing Channel – 22.8 MGD
Tribal Hatchery – 19.5 MGD
Reserve Industrial Expansion – 23.4 MGD
Total Gallery Capacity = 85.2 MGD

Proposal No. 6

Description

Proposal No. 6. Obtain All Municipal And Industrial Water Supply From Ranney Collectors

- Proposal Description: Municipal supply from existing Ranney (19 cfs), industrial and fishery supply from new Ranney collectors (150 cfs).
- Critical Items to Consider: Industrial water right capacity includes substantial reserve quantity (55 cfs) not currently used by industry but supplied by new Ranney. Evaluate potential for stream migration away from Ranney collector which may result in capacity reduction. The Kelso Ranney collector near Mt. Saint Helens has operated for many years since the eruption with very minor yield reduction even though 16 feet of sediment were deposited near the collector. The existing Port Angeles Ranney collector capacity can be expanded by adding new laterals or lengthening some of the existing laterals.
- Ways to Implement: Construct new Ranney on west river bank at a depth of approximately 60 feet, upstream of surface water diversion. River alignment above diversion appears to be stable. See Table 3.
- Changes from the Baseline Concept: Reduce design flow for industrial infiltration gallery from 300 cfs (baseline) to 150 cfs, add 150 cfs from new Ranney collectors, eliminate need for industrial pretreatment.

Advantages	Disadvantages
• Potentially eliminate need for industrial pretreatment, may require upgrades to existing plant. • Minimal disruption to river stream bed. • Expect better performance and reliability over infiltration gallery. • Lower O&M cost.	• Potential for clogging. • Increased capital costs. • Filter efficiency of Ranney unknown under anticipated conditions.

Potential Risks

Reduction of existing Ranney collector yield due to river migration. Unknown water quality from Ranney effluent.

Proposal No. 6

Cost Items		Nonrecurring Costs
Target Cost*	$	22,000,000
Value Concept	$	44,500,000
Avoidance	$	(22,500,000)
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**(22,540,000)**

* IEIS baseline $16,500,000 x 1.33 = $22,000,000
*IEIS baseline cost includes infiltration gallery and industrial pretreatment cost.

Table 3. Proposal No. 6. Intake Design Flows

Existing Ranney Collector
Municipal supply – 12.3 MGD

New Ranney Collector
Daishowa – 19.5 MGD
State Rearing Channel – 22.8 MGD
Tribal Hatchery – 19.5 MGD
Reserve Industrial Expansion – 22.9 MGD
Total New Ranney Capacity = 97 MGD

Proposal No. 7

Description

Proposal No. 7. Obtain All Water Supply From Infiltration Gallery, Existing Ranney as Backup

- Proposal Description: Municipal, industrial and fisheries supply from infiltration gallery, existing Ranney as backup.
- Critical Items to Consider: Sediment load and "break through" on infiltration gallery.
- Ways to Implement: Infiltration upgrades to existing Ranney system (i.e., backwash), infiltration gallery construction in the river channel upstream of current diversion structure (as on baseline), or infiltration gallery constructed on river bank as "in-situ slow sand filter." See Table 4.
- Changes from the Baseline Concept: Larger infiltration gallery, more pre-treatment for Municipal flows, upgraded existing Ranney collector used as backup, no new Ranney collector.

Advantages	Disadvantages
• Provides high quality backup.	• Requires pretreatment of municipal and fishery supply. • Potential clogging of infiltration gallery. • Filter efficiency of infiltration gallery unknown under anticipated conditions.

Potential Risks

Infiltration gallery clogging, reduced yield.

Proposal No. 7

Cost Items		Nonrecurring Costs
Target Cost*	$	14,365,000
Value Concept	$	8,600,000
Avoidance	$	5,765,000
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**5,725,000**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000

Table 4. Proposal No. 7. Intake Design Flows

Infiltration Gallery
Municipal – 12.3 MGD
Daishowa – 19.5 MGD
State Rearing Channel – 22.8 MGD
Tribal Hatchery – 19.5 MGD
Reserve Industrial Expansion – 35.5 MGD
Total Infiltration Gallery Capacity = 109.4 MGD

Proposal No. 8

Description
Proposal No. 8. Obtain Fishery and Reserve Industrial Supply From Infiltration. • Proposal Description: Municipal supply from existing Ranney collector (12.4 MGD), Daishowa supply from new Ranney collector (12.9 MGD), fishery and reserve industrial supply from new infiltration gallery (72 MGD). • Critical Items to Consider: Location of facilities, quality of water from infiltration gallery for fisheries. • Ways to Implement: Infiltration upgrades to existing Ranney system (i.e., backwash), new Ranney constructed on west bank of river, infiltration gallery construction in the river channel upstream of current diversion structure (as on baseline), or infiltration gallery constructed on river bank as "in-situ slow sand filter." See Table 9. • Changes from the Baseline Concept: Add Ranney collectors for industrial supply, reduce size (supply required from) of infiltration gallery, reduce the quantity of water required for industrial pretreatment.

Advantages	Disadvantages
• Minimize quantity required for pretreatment/ minimize sludge production.	• Providing industrial pretreatment for water not currently used, may consider surface diversion for reserve supply which may not be utilized until long after dam removal.

Potential Risks
Infiltration gallery clogging, reduced yield. Unpredictable quality out of Ranney or infiltration gallery.

Proposal No. 8

Cost Items	Nonrecurring Costs	
Target Cost*	$	14,365,000
Value Concept	$	11,800,000
Avoidance	$	2,565,000
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**2,525,000**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000

Table 5. Proposal No. 8. Intake Design Flows

Existing Ranney Collector
Municipal supply – 12.3 MGD

New Ranney Collector
Daishowa – 19.5 MGD

Infiltration Gallery
Daishowa (excess) – 6.5 MGD
State Rearing Channel – 22.8 MGD
Tribal Hatchery – 19.5 MGD
Reserve Industrial Expansion – 35.5 MGD
Total Infiltration Gallery Capacity = 72 MGD

Proposal No. 9

Description

Proposal No. 9. Bench Top Disk Filter Testing.

- Proposal Description: Bench top disk filter testing. See Table 6.
- Critical Items to Consider: Representative sediment samples.
- Ways to Implement: Obtain sediment cores from behind dams.
- Changes from the Baseline Concept: Adds a new surface diversion filtering option that may reduce unit process cost further.

Advantages	Disadvantages
• Reduce treatment cost.	• Obtaining representative samples.

Potential Risks

Results may not represent full operating conditions.

Cost Items	Nonrecurring Costs	
Target Cost*	$	14,365,000
Value Concept**	$	9,500,000
Avoidance	$	4,865,000
Value Study Costs	$	40,000
Implementation Costs	$	0
Net Avoidances	**$**	**4,825,000**

* IEIS baseline $10,800,000 x 1.33 = $14,365,000
** Reduced unit process cost is likely result in savings up to $5,000,000, depending on test results.

Table 6. Proposal No. 9. Bench Scale Testing

Contact Representative of equipment manufacturers of disk filters
-Setup 0.1 sq.ft. filter media

Run three different concentrations 1,000 to 40,000 mg/l at two different vacuums 15" Hg and 10" Hg

Manufacturer's representative simulate their equipment operation-submerge time, etc.

Document and Publish
1. Cake solids
2. Filtrate solids
3. Filtrate volume/unit time
4. Cake release and filtration rate recovery

Work with three different manufacturers, testing should be no cost for equipment or lab work. Manufacturers provide test set-up.

Value Study Elements Considered as Potential Proposals and Their Disposition	
Idea	**Disposition**
Floating Fabric Storage (5-10 day).	Not developed in favor of other storage ideas.
Pumped Storage (underground).	Considered by study team to be infeasible.
Line and use Rayonier Mill tank for storage.	Developed as part of Proposal No. 1.
Fill up converted oil tanker for storage.	Not developed in favor of other storage ideas.
Barge mounted desalting plant in the strait for water supply.	Refer to the design team for consideration.
Pay for Daishowa Mill reduced operations or temporary closures.	Refer to the design team for consideration.
Build enhanced water treatment system with state of the art controls, operating with minimum labor.	Refer to the design team for consideration.
Use Morse Creek as a permanent municipal water supply.	Not developed; insufficient creek flows.
Use groundwater wells as emergency or temporary supply when turbidity is too high.	Refer to the design team for consideration.
Use new and existing Ranney collectors as permanent source for all water use.	Developed as Proposal No. 6.
Drill an exploratory well to test for groundwater yield.	Refer to the design team for consideration.
Remove Glines Dam first to partially control sediment impact and mitigation needs.	Refer to the design team for consideration.
Build reservoir and treatment facility at the Rayonier site.	Developed as part of Proposal No. 1.
Combine Tribal and State Fisheries.	Refer to the design team for consideration.
Increase treated storage capacity.	Developed as Proposal No. 2.
Increase treated and raw water storage (5-10 days).	Refer to the design team for consideration.
Construct infiltration gallery on Elwha River above the dams (Lake Mills) to supply all water needs during dam deconstruction.	Refer to the design team for consideration.

Disposition of Ideas	
Cut municipal demand by conservation and economic incentives.	Refer to the design team for consideration.
Promote water efficient fixtures.	Refer to the design team for consideration.
Ration water in Port Angeles during high turbidity periods.	Refer to the design team for consideration.
Switch to ozone disinfection during deconstruction to eliminate concerns with trihalomethane (THM).	Refer to the design team for consideration.
Upgrade Daishowa water treatment plant to optimize process and water use.	Refer to the design team for consideration.
Combine domestic/industrial infiltration galleries.	Developed as part of Proposal Nos. 5, 7, and 8
Diatomaceous Earth treatment for potable; and combination of reuse and storage for non-potable water during dam removal.	Refer to the design team for consideration.
Relocate State Fishery (Rearing Channel).	Refer to the design team for consideration.
Reduce municipal demand by implementing wastewater reuse; install purple pipes.	Refer to the design team for consideration.
Recycle water through fisheries during high turbidity periods.	Refer to the design team for consideration.
Use solids from coagulation/floculation for beach rebuilding or landfill cover.	Refer to the design team for consideration.
Use industrial disk filter pretreatment.	Developed as part of Proposal No. 9.
Postpone construction/use of New Ranney Well and restore and maintain yield of existing Ranney by periodic jetting of laterals and flushing of materials or by adding new laterals.	Refer to the design team for consideration.
Use centrifugal sand separators.	Refer to the design team for consideration.
Use sluicing system to separate coarse sediments.	Refer to the design team for consideration.
Develop a true groundwater system for permanent municipal supply to avoid surface water treatment rule.	Refer to the design team for consideration.
Promote 75 percent industrial water reuse.	Refer to the design team for consideration.

Disposition of Ideas

Avoid withdrawing any water from Elwha during high turbidity.	Refer to the design team for consideration.
Use porous ceramic system for removal of solids.	Developed as Proposal No. 3.
Use proceeds from electric generation sales to fund mitigation.	Refer to the design team for consideration.
Use Ultraviolet disinfection to reduce disinfection by-products (DBP).	Refer to the design team for consideration.
Use pilot systems.	Developed as part of Proposal No. 4
Use benchtop tests, for example test membranes with core samples.	Developed as part of Proposal No. 9
Analyze and test competing technologies.	Refer to the design team for consideration.
Define available acreage at existing facilities for comparison to new facility footprints.	Refer to the design team for consideration.
Bring product/equipment representatives to site for consultation.	Refer to the design team for consideration.
Identify model municipalities performance (i.e., the Ranney collector at Kelso on the Cowlitz River, near Mount Saint Helens.	Refer to the design team for consideration.
Gather more information on infiltration gallery performance and Ranney collector performance.	Refer to the design team for consideration.
Use Ultraviolet disinfection with no residuals. Monitor residuals with non-heterotropic system.	Refer to the design team for consideration.
Look at the risk/benefit of the total systems.	Refer to the design team for consideration.
Make new facilities modular to allow increases/decreases during dam removal.	Refer to the design team for consideration.
Sell concrete to recycler to fund mitigation.	Refer to the design team for consideration.

List of Consultants

Consultant or Contact	Topic or Information
Mr. Tom Grove Director of Sales and Marketing BASX Systems, LLC 3801 Automation Way, Suite 200 Fort Collins, CO 80525-3434 Phone 1-800-722-2279	Ceramic Microfilters.
Mr. Paul Reebs Plant Manager City of Kelso Kelso, WA 360-577-1085	Performance of Kelso Ranney well (in vicinity of Mount Saint Helens).
Mr. Larry Ward Hatchery Manager Lower Elwha Klallam Tribe 51 Hatchery Road, Port Angeles, WA 360-457-4012	Performance of the existing tribal infiltration gallery.
Mr. Jim Bays Director of Public Works City of Sequim Sequim, WA	Performance of groundwater wells in the vicinity of Sequim.
John Ryding Regional Engineer Washington State Department of Health SW Drinking Water Operations 2411 Pacific Avenue, P.O. Box 47823, Olympia, WA 98504-7823 Phone: 360-753-2452 FAX: 360-664-8058 E-mail: john.ryding@doh.wa.gov	Compliance and possible State concerns with proposals.
Greg Blais Staff Engineer URS Corp. Stanford Place 3, Suite 1000, 4582 South Ulster Street, Denver CO 80237 Phone: 303-694-2770 FAX: 303-694-3946 E-mail: greg_blais@urscorp.com	Project background, current activities, owner, user, stakeholder issues.

Data and Documents Consulted

Title, Author, and Date	Information
Elwha River Ecosystem Restoration, Final Environmental Impact Statement, Olympic National Park, June 1995	Projected Elwha water quality and proposed mitigation measures.
Elwha River Ecosystem Restoration Implementation, Draft Environmental Impact Statement, Olympic National Park, April 1996	Water Quality Mitigation Issues.
Elwha River Ecosystem Restoration Implementation, Final Environmental Impact Statement, Olympic National Park, November 1996	Water quality mitigation issues and concepts.
Removal of Elwha and Glines Canyon Dams, Elwha Technical Series PN-95-7, USBR, May 1996	Sedimentation loadings.
Water Quality Analysis and Mitigation Measures, Elwha Technical Series PN-95-8, USBR, March 1997	Projected Elwha water quality, conceptual design of mitigation measures described in IEIS.
R S Means Site Work and Landscape Cost Data, 19th Annual Edition. RS Means Group, 1999, Kingston MA.	Unit and assembly costs.
Comprehensive Water System Plan, City of Port Angeles. CH2Mhill, 1995.	Proposals to build additional 5.5 mg treated water storage facilities in the high pressure zone.
Suspended Sediment Filtration Through Riverbed Investigation, Gathard Engineering and Consulting	Ranney collector data for Lower Elwha-Klallam Hatchery.
Ground-Water Resource Assessment Technical Memorandum, Bureau of Reclamation, October 1995 (September 1999)	Available groundwater quantities for water source.
Elwha River Ecosystem and Fisheries Restoration Project, Elwha Technical Series PN-95-9, (SED analysis and modeling) BOR, October 1996	Sediment loadings and concentrations.
Report of Hydrologic Services Water Supply Feasibility Study, Tribal Fish Culture Facility, Geoengineers, June 1994	Water quality, quantity and needs.

Data and Documents Consulted	
Preliminary Evaluation of Elwha Dam Removal Mitigation Alternatives and Integration with Regional Supply Objectives, CH2M Hill, 1999	Current project and proposals.
Permanent Treatment for Port Angeles' Domestic Water Supply as a Result of Removal of the Elwha Dams, CH2M Hill, 1999	Current project and proposals.

Design Team Presentation Attendance List
September 11, 2000 - 10 a. m.

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